FAKIDOV, I. G.

PA 55/49T96

USSR/Physics
Hall Effect

Nov. 48

"The Hall Effect in Liquid Rubidium," I. G. Fakidov, Lab of Elec Phenomena, Inst Phys of Metals, Ural Affiliate, Acad Sci USSR, 2½ pp

"Dok Ak Nauk SSSR" Vol LXIII, No 2

Hall constant for liquefied rubidium was shown to have a normal sign and a magnitude R (-4.2±0.5)·10⁻⁴; for solid rubidium, R=-5.10⁻⁴ CGSM. There is apparently no reason to assume that galvanomagnetic and thermomagnetic effects cannot be observed in liquid metals. Submitted by S. I. Vavilov 6 Sep 48.

USSR 55/49T96

FAKIDOV, I. G.

35821. Raboty laboratorii elektricheskikh yavleniy. Trudy in-ta fiziki metallov, vyp. 12, 1949, S 83-85.-Bibliogr: 21 nazv.

SO: Letopis' Zhurnal'nykh Statey, Vol. 39, Moskva, 1949

Ma

2

"The Influence of a Magnetic Field on the Electrical Resistance of a Ferromagnetic Manganese-Antimony Alloy. I. G. Fakidov and N. P. Grazhdankina (Doklady Akad. Nauk S.S.S.R., 1949, 66, (5), 847-849).—[In Russian]. Alloys contg. 50 and 54 at.-% Sb were studied; they were prepared by melting in evacuated silica tubes followed by slow cooling. Specimens of dimensions 0·5 × 2 × 30 mm. were made by grinding. Cu leads were attached to the Cu-plated ends of the specimen, which was mounted horizontally on an ebonite holder mounted coaxially with the electromagnet. The relative positions of the specimen and the electromagnet could be determined to within a fraction of a degree. At room temp. the alloy with 54 at.-% Sb has $\Delta R_{\parallel}/R$ positive and $\Delta R_{\perp}/R$ negative up to 5000 Oe., above which it is positive. Similar results were obtained for the alloy containing 50 at.-% Sb. The results were, however, at variance with those of other workers on other materials. Therefore, as a check, experiments on a Ni specimen were carried out. The results were the same as those obtained by other authors. Since Akulov's theory ("Ferromagnetism", 1939; Moscow) does not explain the results on Mn-Sb alloy satisfactorily, some other explanation is required.

—Z. S. B.

Inst. Phys. of Metals: Ural Affil., Acad. Sci. Sverdlovsk, c1949-
Mbr., Lab. Electrical Phenomena

FAKIDOV, I. G.

PA 149T84

USSR/Physics - Ferromagnetics 21 Sep 49
Electroconductivity

"Electroconductivity of the Ferromagnetic Alloy Chromium-Tellurium," I. G. Fakidov, N. P. Grazhdankina, A. K. Kikoin, Inst Phys of Metals, Ural Affiliate, Acad Sci USSR, 2 pp

"Dok Ak Nauk SSSR" Vol LXVIII, No 3 pp. 491-92

Extensively studied electrical, thermal, and magnetic properties of chromium-tellurium alloys. Studied temperature dependence of specific resistance for a Cr-Te alloy close to stoichiometric composition (48.5 atomic % Te and 51.5 atomic % Cr) and influence of magnetic field

[redacted] 149T84

USSR/Physics - Ferromagnetics (Contd) 21 Sep 49

upon resistance of this alloy. Sharp change in curve formed by plotting specific resistance versus temperature (characteristic of the Curie point in all ferromagnetics) was found at 58° C. Alloy's specific resistance at room temperature was 5×10^{-4} ohm/cm, which is 25 times greater than that of pure chrome (2×10^{-5} ohm/cm). Submitted by Acad S. I. Vavilov 13 Jul 49.

[redacted] 149T84

FAKIDOV, I. G.

178T93

USSR/Physics - Ferromagnetics
Heat Capacity 1 Nov 50

"Investigation of the Heat Capacity of Ferromagnetic Chromium Sulfide," I. G. Fakidov, N. P. Grazhdankina, Inst Phys of Metals, Ural Affiliate, Acad Sci USSR

"Dok Ak Nauk SSSR" Vol LXXV, No 1, pp 19, 20

Study peculiar dependence of sp heat capacity C_p of ferromagnetic chromium sulfide (varies 0.134 kal/g deg to 0.165 and back to 0.145) upon temp theta (varying θ to 80°C); also magnetic susceptibility (4/1,000 to 0 units) vs temp

178T93

USSR/Physics - Ferromagnetics (Contd) 1 Nov 50

(15°C to 110°C) for various fld (112, 172, 220 oersteds). Submitted 11 Jul 50 by Acad I. P. Bardin.

178T93

FAKIDOV, I.G.

Electric and electromagnetic properties of chromium sulfides. N. P. Grazhdankina and I. G. Fakidov. *Doklady Akad. Nauk S.S.S.R.* 93, 429-30(1953).—The elec. resistance of the S-Cr systems was measured at 1.8, 4.2, 13.8, 20, and 77°K. Systems contg. 60-61 at. % S have a small residual cond., as in the case of nonsuperconducting metals, but with a large excess of S (58-59 at. %) they are insulators at low temps. No Hall effect could be observed with any sulfides in spite of the very high sensitivity of the app. The effect of magnetic fields on the Cr sulfide resistance was too low to be measured, except for the system contg. 58-59% S, where the effect was anomalous ($\Delta R/R$ was neg.) similar to that found with Te. W. M. Sternberg

1

FAKIDOV, I. G.

Heat capacity of ferromagnetic chromium sulfide in the region of higher Curie temperature. I. G. Fakidov and N. P. Grazhdankina. *Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial* 15, 60-4(1954).—Heat capacity (I) of ferromagnetic $CrS_{1.17}$ was measured between 0 and 100°. A sharp max., extrapolated to a value of 0.1745 cal. per g. per degree, was observed at 28°, which is the 2nd (higher) Curie point. Above 40°, I increased slowly and linearly with temp. The jump of I at Curie point was 1.25R per mol. (R = gas constant). A. Dravnieks

CH

(1)

FAKIDOV, I.G.

Electrical properties of chromium sulfides. I. G. Fakidov and N. P. Grazhdankina. *Trudy Inst. Fiz. Metal., Akad. Nauk S.S.S.R., Ural. Filial* 15, 65-9(1954).—Elec. cond. of CrS with 50-60 at. % S has a max. at 54 at. % S, with sp. resistance (I) 4×10^{-4} ohm cm. Below 50% S, the temp. coeff. of I is pos. Between 50 and 53% S, the coeff. is pos. in the range 0-233°K., but becomes neg. above 233°K.; at higher S %, the change of the sign of the coeff. occurs at higher temps. For CrS with 54% S, the I vs. temp. curve indicates existence of 2 Curie points, at −110 and +30°, as substantiated by magnetic measurements. Activation energy of elec. cond. of compds. with 50 and 52 at. % S between 0 and 100°C. is 0.016 and 0.01 e.v., resp., at lower temps., and 0.08 and 0.03 e.v. at higher temps., with a distinct sepn. between the regions of different slopes. With a decrease of temp. towards 0°K., some compns. of CrS tend towards small limiting I, while CrS with 58% S becomes nonconducting. CrS with excess S shows no Hall effect. The change of I in magnetic field is zero for CrS with excess S, and neg. for excess Cr. CrS belongs to compds. intermediate between metals and semiconductors. The impurity levels lie within the cond. band, and the narrow forbidden energy band permits passage of electrons directly from the normal to the cond. band. The absence of the Hall effect is explained by simultaneous formation of free electrons and holes. Above 57 at. % S, the cond. band has no free electrons at normal temp. The ferromagnetic CrS has thermal e.m.f. coeff. 0.02 mv. per degree.

Andrew Dravnieks

CH

4

FAKIDOV, I. G. and GRAZHDANKINA, N. P.

"The relation of exposing the defects to the blackening density when X-raying steel with gamma rays of cobalt-60", p 54,

"Exposure graphs for X-raying steel with gamma rays of cobalt-60, calculating the dispersed rays", p 61,

Both appearing in the "Detection of Defects in Metals by Gamma -- Collection of Papers", (Gamma Defektoskopiya Metallov -- Sbornik Statei), published by the Academy of Sciences USSR, 1955.

FAKIKOV, I. G. and SAMOKHVALOV, A. A.

"Testing the properties and characteristics of a gamma defect detector with an ionization counter", appearing in the "Detection of defects in Metals by Gamma -- Collection of Papers", (Gamma Defektoskopiya Metallov -- Sbornik Statei), published by the Academy of Sciences USSR, p 109, 1955.

7804

IONIZATION METHODS FOR DETERMINATION OF DEFECTS OF THICK SECTIONS OF METAL BY GAMMA-RAYS. I. G. Fakidov and A. A. Samokhvalov. p.165-81 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

HG

A description is given of work connected with making ionization gamma instruments for testing thick metal parts. The advantages of the use of counters in gamma defectoscopy are: higher sensitivity, higher test speed, the possibility of constant control of a moving part, the cut in cost due to the fact that X-ray film and other photographic materials are not used. The instrument consists of the following main parts: a gamma radiation direction device, a mechanical and electric-power portion for moving the gamma-ray beam system with respect to the part being tested, and the recording portion. The most convenient gamma source for testing parts of thickness 250 to 300 mm is the Co-60 isotope. For thicknesses of steel from 70 to 100 mm, use may be made of isotope Ir-134 or Ir-192, though the latter is less convenient because of its small half life of 2.5 months. The gamma counter in the instrument was either a scintillation counter or a self-extinguishing gas-filled counter. An investigation of the properties of the gamma instrument showed a considerable influence of the parameters of the geometric scheme of the instrument on its sensitivity. An optimum instrument was selected on the basis of experiments in which changes were made in the dimensions of the container, the channel diameter of the container, the size of the counter screen, the diameter of the counter screen window and the relative positions of the source, the part being tested and the counter. The problem of the correspondence between the size of internal defects and the heights of the peaks on the defectograms registered by self-recording potentiometers was clarified. The sensitivity of the instrument depends on the control conditions. In the case of parts with a small difference of wall thickness, the sensitivity may reach a fraction of a percent. With respect to parts of thickness up to 300 mm, and of complex form with a large difference of wall thickness, the sensitivity of an instrument with a self-extinguishing counter permits location of defects up to 3% in the case of a slightly active source (1.5 curies). An instrument with a scintillation counter has a sensitivity 2 to 3 times greater (1-1.5%). The control speed in the case of complex-form parts with a large difference of wall thickness is 30 cm²/min. The control result is recorded on the defectogram. With parts of the same thickness, the control speed may be increased several times. The possibility of using a new detector of gamma radiation (a crystal of cadmium sulphide together with phosphorus) is also reported. This detector was studied in the laboratory. (auth)

1

FAKIDOV, I. G.

USSR/Electricity - Semiconductors G-3

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 7050

Author : Margolin, S.D., Fakidov, I.G.

Inst : Institute of Physics of Metals, Ural Branch, Academy of Sciences, USSR, Sverdlovsk.

Title : Use of Photoresistances of Cadmium Sulfide in Conjunction with Phosphors as a Detector for Gamma Rays from Co^{60}.

Orig Pub : Fiz. metallov i metallovedeniye, 1955, 1, No 2, 379-383

Abstract : A photoresistance made of CdS is quite sensitive to the visible and to X-rays. However, attempts made to use CdS crystals to record the hard gamma rays have shown that the sensitivity of CdS to radiation from Co^{60} (1.17 and 1.33 Mev) is small. It is shown that in conjunction with phosphorescent NaI (Tl) or CsI (Tl), which emit under the influence of gamma rays a visible light of a frequency close to the frequency of the maximum sensitivity of CdS, the photoresistance can be used as a detector for gamma rays from Co^{60}. The advantage of such a detector over scintillation counters is the simplicity of the electrical circuit and the absence of the need for photomultipliers and high-viltage stabilized supply.

Card : 1/1

FAKIDOV, I.G.; GRAZHDANKINA, N.P.

Thermal capacity of ferromagnetic chromium sulfide in the upper Curie temperature range. Trudy Inst. fiz. met. no.15:60-64 '55. (MLRA 8:6)

(Chromium sulfide--Magnetic properties)

FAKIDOV, I.G.; GRAZHDANKINA, N.P.

Electric properties of chromium sulfide. Trudy Inst. fiz. met. no.15:65-69 '55. (MLRA 8:6)
(Chromium sulfide--Electric properties)

FAKIDOV, I.G.

USSR/ Chemistry - Physics of metals

Card [redacted] Pub. 22 - 28/54

Authors : Grazhdankina, N. P., and Fakidov, I. G.

Title : Natural conductivity of chromium sulfide

Periodical : Dok. AN SSSR 102/5, 957-960, Jun 11, 1955

Abstract : The electrical properties of chromium sulfides, classed as belonging to the group of substances, the electric conductivity of which is due to additive combination of the emi-conductive conductivity mechanism with the metallic mechanism, were investigated at high temperatures. It was found that these sulfides dissociate at high temperatures and this results a change in the composition of the compound which in turn causes a change in the concentration of conductivity electrons and in the Hall effect. The effect of

Institution : Acad. of Sc., USSR, Ural Branch, Inst. of the Phys. of Metals

Presented by : Academician I. P. Bardin, December 3, 1954

* partial vapor pressure and temperature fluctuations on the conductivity of chromium sulfides is explained. Six references.

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000412410004-5"

Fakidov, I. G.

2

5848

APPLICATION OF CdS PHOTORESISTANCE IN COMBINATION WITH PHOSPHORS AS THE DETECTOR OF COBALT 60 GAMMA RAYS. S. D. Margolin and I. G. Fakidov (Urals Inst. of Metal Physics) Doklady Akad. Nauk S.S.S.R. 105, 976-7(1955) Dec. 11. (In Russian).

The photoresistance of a CdS monocrystal was tested in a scintillation counter with naphthalene, toluene, cesium iodide, and sodium iodide, and Co^{60} isotope with 0.6g-equivalent of radium as a gamma radiation source. The tables show CdS photoresistance without the phosphors and with various phosphor combinations. The highest sensitivity was observed in the presence of sodium iodide. The results of the study showed that CdS can be used as an effective detector of γ rays. (R.V.J.)

FAKIDOV, I. G., and GRAZHDANKINA, N. P., (Sverdlovsk)

"Connection of the Magnetic and Electrical Properties of Chrome Sulphides," a paper submitted at the International Conference on Physics of Magnetic Phenomena, Sverdlovsk, 23-31 May 56.

FAKIDOV, I.G.; GRAZHDANKINA, N.P.; NOVOGRUDSKIY, V.N.

Electric properties of manganese-germanium alloys, Izv. AN SSSR. Ser. fiz. 20 no.12:1509-1518 D '56. (MIRA 10:3)

1. Institut fiziki metallov Ural'skogo filiala AN SSSR.
(Manganese-Geranium alloys--Electric properties)

FAKIDOV I.G.

Category : USSR/Solid State Physics - Structure of Deformable Materials E-8

Abs Jour : Ref Zhur - Fizika, No 2, 1957 No 3949

Author : Fakidov, I.G., Samokhvalov, A.A.

Title : Gamma Defectoscope with Scintillation Counter.

Orig Pub : Zavod. laboratoriya, 1956, 22, No 6, 673-677

Abstract : The use of scintillation counters in gamma defectoscopy has many advantages both compared with the photography method of recording the radiation, and compared with defectoscopes with Geiger-Mueller counters in that it has a higher sensitivity and speed of control and that continuous control of a moving object is possible. A defectoscope was designed for the control of articles with a thickness up to 250 -- 300 mm. The defectoscope is quite stable and its indications are readily reproducible. The sensitivity of the instrument is 2 -- 2.5%.

Institute fiziki metallov Ural'skogo filiala Akademii nauk SSSR. (Gamma rays--industrial applications) (Metals--testing) (Scintillation counters)

Card : 1/1

FAKIDOV, I. G.

4

19

Some Characteristics of the Scintillation Counter and its Use for Technical Purposes. I. G. Fakidov and A. A. Samokhvalov. (*Zavodskaya Laboratoriya*, 1956, 22, (6), 678-682). [In Russian]. An account is given of characteristics of scintillation counters which affect their suitability of gamma-ray detection with sufficient stability under works conditions. A possible arrangement of apparatus for this purpose is described. 19

1-RMF
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FAKIDOV, I. G. and SAMOKHVALOV, A. A.

"Data on a Simple Scintillation Couter, its Characteristics and its Application in 4-type Flaw Detection."

A conference on Electron and Photo-Electron Multiplier; Radiotekhnika i Elektronika, 1957, Vol. II, No. 12, pp. 1552-1557 (USSR)

Abst: A conference took place in Moscow during February 28 and March 6, 1957 and was attended by scientists and engineers from Moscow, Leningrad, Kiev and other centres of ;the Soviet Union. Altogether, 28 papers were read and discussed.

FAKidov I. G.

AUTHORS: Buzynov, A.Ye. and Fakidov, I.G. 120-4-27/35

TITLE: A Gamma-exponometer (Exposure Calculator) for Betatron Defectoscopy (Gamma-eksponometr dlya betatronnoy gamma-defektoskopii)

PERIODICAL: Pribory i Tekhnika Eksperimenta, 1957, No.4, pp. 94 - 95 (USSR)

ABSTRACT: A gamma-exposure calculator is described which enables the exposure time to be rapidly calculated. It is suitable for gamma-defectoscopy with steel thicknesses 30 - 570 mm using betatron gamma irradiation of energies of 22 MeV over a wide intensity range. The gamma-exposure calculator (Fig.1) has five discs rotatable round a common axis. On the discs are five scales: 1) exposure time scale; 2) steel thickness scale; 3) intensity scale for the betatron irradiation (1 - 100 r.p.m.); 4) a scale of the distance from the beta-tron/target to the film (0.1 - 10 m), and 5) film sensitivity values from 1 to 10. The method of use is described. There are 1 figure and 2 non-Slavic references.

ASSOCIATION: Ural Branch Ac.Sc. USSR, Institute of the Physics of Metals (Ural'skiy filial AN SSSR, institut fiziki metallov)

Card

AUTHORS: Samokhvalov, A. A. and I. G. Fakidov. 126-2-11/30

TITLE: The Hall effect and the influence of a magnetic field on the resistance of magnetite. (Effekt Kholla i vliyaniye magnitnogo polya na soprotivleniye magnetita).

PERIODICAL: "Fizika Metallov i Metallovedeniye" (Physics of Metals and Metallurgy), Vol.IV, No.2, 1957, pp. 249-256. (U.S.S.R.)

ABSTRACT: Measurement of the galvanomagnetic effects was carried out on two specimens of magnetite. Specimen No.1 was polycrystalline and was in the form of a parallelepiped 6 x 12 x 52 mm. Specimen No.2 was cut from an octahedral monocrystalline specimen (parallel to a face in the 111 plane) and was in the form of a plate 9.1 x 18.2 mm and 2.8 mm thick. The method of measurement is indicated in Fig.1. The resistivity of specimen No.1 was 1.63 Ohm.cm., and the resistivity of specimen No.2 was 1.27 Ohm.cm. The conductivity was found to be electronic (from the sign of thermal e.m.f.). Results indicate that the Hall e.m.f. may be described by the usual formula for ferromagnetic metals:

$$E_x = R_o(H_i + 4\pi aM)jb$$

where R_o - Hall constant for the "ordinary" part of the

Card 1/3

effect, aR_0 - Hall constant for the "extraordinary" part of the effect, characteristic of ferromagnetics, H_i - field intensity within the specimen, j - primary current density through specimen, and b - width of specimen. Both a and R_0 are found to be positive. In the saturation region the Hall e.m.f. decreases (cf. ref.3). The order of the magnitude of R_0 ($\sim 10^{-1} - 10^{-2}$ cm^3/coulomb) corresponds to semiconductor concentration of electrons, equal to 10^{20} cm^{-3}. There is some dispute as to whether it is legitimate to estimate the carrier concentration from the value of R_0 in the above formula in the case of ferromagnetics (cf. ref.4). The resistance of magnetite in a magnetic field decreases in the case of both transverse and longitudinal effects. This is explained by a "volume effect" by Volkov, D.I., (4). Experimental curves of $\frac{\Delta r}{r_{\parallel}}$ and $\frac{\Delta r}{r_{\perp}}$ as functions of H can be described by:

$$\frac{\Delta r}{r} = A + B\,(H_i + 4\pi a M)^2$$

It is shown that (eq.7)

$$\frac{E_x}{jb} = R_o H_e \left[1 - \frac{N (\mu - 1)}{\mu N - N + 4\pi} + \frac{4\pi a (\mu - 1)}{\mu N - N + 4\pi} \right]$$

where H_e is the external field, N the demagnetisation factor and $\mu = B/H_i$. Using this formula, R_o and a can be determined from experimental curves of

$$\frac{E_x}{jb} = f(H_e).$$ Since for a thin plate N is known to be approximately equal to 4π. The values obtained are given in Table 1. There are 3 tables, 8 figures and 6 references, 4 of which are Slavic.

Card 3/3

SUBMITTED: October 5, 1956.

ASSOCIATION: Institute of Metal Physics, Ural Branch, Ac.Sc.,USSR. (Institut Fiziki Metallov Ural'skogo Filiala AN SSSR).

AVAILABLE:

Fakidov, I.G.

126-2-25/35

AUTHORS: Margolin, S.D., and Fakidov, I. G.

TITLE: Temperature dependence of the magnetization of the alloy containing 30 at.% Mn, 70 at.% Ge. (Temperaturnaya zavisimost' namagnichennosti splava Mn 30 at.%, Ge 70 at.%).

PERIODICAL: Fizika Metallov i Metallovedeniye, 1957, Vol.5, No.2, pp. 368-369 (USSR)

ABSTRACT: The results are described of preliminary investigations of the temperature dependence of the magnetization of the alloy containing 30 at.% Mn and 70 at.% Ge in the temperature range liquid nitrogen up to 120°C, in magnetic fields between 20 and 2400 Oe. Zwicker, I., et alii (Ref.1) studied the diagram of state of Mn-Ge alloys and showed that the compounds Mn_5Ge_2 and Mn_5Ge_3 are strongly ferromagnetic at low temperatures. Gastelliz (Ref.2) described results of magnetic investigations of Mn_5Ge_3.

Guigg, K. J., et alii (Ref.3) give data on the residual magnetization and the coercive force of Mn_5Ge_2 and Mn_5Ge_3. Fakidov, I. G., (one of the authors) et alii (Ref.4) detected existence of two temperatures of ferromagnetic transformation when studying the electric conductivity of the alloys of the Mn-Ge system. The alloy containing

Card 1/4

126-2-25/35

Temperature dependence of the magnetization of the alloy containing 30 at.% Mn, 70 at.% Ge.

30 at.% Mn and 70 at.% Ge, investigated by the authors of this paper, was produced from electrolytic manganese of 99.8% purity, purified by distillation in a high frequency furnace, and germanium of 99.997% purity with a specific resistance of 1.4 Ohm/cm. The alloy was produced from a mixture of Mn and Ge placed into a quartz ampule which was evacuated to 10^{-5} mm Hg. The quartz ampule and its contents were heated in a furnace to a temperature exceeding about 200°C the melting temperature of the alloy (according to the diagram of state), held for two hours at that temperature and, following that, the melt was cooled to a temperature 50°C below the melting point at which it was held for two hours and then slowly cooled in the furnace to room temperature. From the thus produced alloy a specimen 0.402 x 0.302 x 2.0 cm was made; the magnetic measurements were effected by means of a ballistic method. It can be seen from the curves of the temperature dependence of the magnetization shown in Fig.1 that the alloy containing 30 at.% Mn and 70 at.% Ge has two temperatures of ferromagnetic transformation in the case of a field strength of 2400 Oe. One of these

Card 2/4

126-2-25/35

Temperature dependence of the magnetization of the alloy containing 30 at.% Mn, 70 at.% Ge.

equals 10°C and is independent of the field strength, whilst the second is in the temperature range -125 to -143°C and does depend on the magnetic field strength. The maximum magnetization occurs at 100°C for all the field strengths comprised in the tests. Fig.2 shows the magnetization curves of the 30 at.% Mn, 70 at.% Ge alloy at various temperatures, which indicates that for field strengths up to 2400 Oe. the magnetization has a linear dependence on the magnetic field strength at the temperature of liquid nitrogen. For elucidating the physical nature of these two temperatures of ferromagnetic transformation of the alloy containing 30 at.% Mn and 70 at.% Ge and other alloys of this system, the authors propose to continue their investigations using more intensive magnetic fields and lower temperatures. Fig.1 shows the temperature dependence of the magnetization of an alloy containing 30 at.% Mn and 70 at.% Ge at various magnetic field strengths (magnetization, Gauss vs. temperature, °K). Fig.2 shows the magnetization curves of an alloy with 30 at.% Mn and 70 at.% Ge at various temperatures (173, 222, 146 and 77°K).

Card 3/4

126-2-25/35

Temperature dependence of the magnetization of the alloy containing 30 at.% Mn, 70 at.% Ge.

There are 2 figures and four references, one of which is Slavic.

(Note: This is a complete translation).

SUBMITTED: March 11, 1957.

ASSOCIATION: Institute of Physics of Metal, Ural Branch of the Ac.Sc., U.S.S.R. (Institut Fiziki Metallov Ural'skogo Filiala AN SSSR).

AVAILABLE: Library of Congress.

Card 4/4

FAKIDOV, I.G.

48-8-11/25

AUTHORS: Grazhdankina, N. P., Fakidov, I. G.

TITLE: The Connection Between the Magnetic and Electrical Properties of Chromium Sulphides (Svyaz' magnitnykh i elektricheskikh svoystv sul'fidov khroma)

PERIODICAL: Izvestiya AN SSSR,Ser.Fiz.,1957, Vol. 21, Nr 8,pp. 1116-1122 (USSR)

ABSTRACT: The following problems are dealt with by this paper: a) The electric conductivity of chromium sulphides of different compositions, b) the dependence of electric conductivity on temperature in a wide temperature interval (1.8 - 1000°K). c) The Hall effect and measuring the resistance in the magnetic field, and d) the thermoelectromotoric force of chromium sulphides of different compositions. Initially, the compound chromium-sulphur was taken as an example. Measurements were carried out according to the potentiometer method with application of compensators and a galvanometer. The measuring of galvanometric effects were carried out under adiabatic and isothermal conditions. In view of the strong phenomena of dissociation occurring at high temperature in the case of chromium sulphides, special pyrex glass coverings were used for the samples. The following results were obtained: 1) According to the absolute value of the specific electric resistance $10^{-4} \div 10^{-2}$ Ω.cm) the substances to be investigated ranged bet-

Card 1/3

Inst for Metal Physics, Ural Branch AS USSR

The Connection Between the Magnetic and Electrical Properties of Chromium Sulphides. 48-8-11/25

ween metals and semiconductors. 2. Temperature measurements showed that within the range of 5o - 54% S content at temperatures of 1.8 to 21o-3ooºK chromium sulphides have the property of "spontaneous polarization", i.e. they have a constant number of electric current carriers, the energy of which is within the range of conductivity. 3. The investigation of electric conductivity within the range of high temperature led to a new discovery, namely to the determination of the investigated substances own semiconductor conductivity at temperatures of 42o.62oºK. 4. On the basis of the thorough investigation of electric conductivity, of the Hall effect, and of the results obtained when measuring the electric resistance of the magnetic field it can be concluded that, in the case of chromium sulphides, the current carriers have an extremely low degree of mobility (1 cm^2V^{-1} sec^{-1}). The concentration of the latter is high = $5.1o^{1o}$ ÷ $1o^{22}$ cm^{-3}. 5. Investigation of the electrical properties of magnetic and antiferromagnetic chromium-sulphur compounds made it possible to state that the moment of the occurrence of ferromagnetism here depends upon the state of the metal. The experimental results obtained confirm the statement made by Heikers concerning theoretical conceptions of the connection between ferromagnetism and the metal state of the substances in the compounds of the metal transitions with the elements of V and VIB subgroups of periodic systems.

Card 2/3

PAKIDOV, I.G.

21(5) PHASE I BOOK EXPLOITATION SOV/2764

Vsesoyuznaya nauchno-tekhnicheskaya konferentsiya po primeneniyu radioaktivnykh i stabil'nykh izotopov i izlucheniy v narodnom khozyaystve i nauke. Moscow, 1957.

Trudy... Mashinostroyeniye i priborostroyeniye (Transactions of the All-Union Conference on the Use of Radioactive and Stable Isotopes and Radiation in the National Economy and Science; Machine and Instrument Manufacturing) Moscow, Izd-vo AN SSSR, 1958. 358 p. 4,500 copies printed.

Sponsoring Agencies: USSR. Glavnoye upravleniye po ispol'zovaniyu atomnoy energii, and Akademiya nauk SSSR.

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PURPOSE: This book is intended for specialists in the field of machine and instrument manufacture who use radioactive isotopes in the study of materials and processes.

COVERAGE: This collection of papers covers a very wide field of the utilization of tracer methods in industrial research and control techniques. The topic of this volume is the use of radioisotopes in the machine-and instrument-manufacturing industry. The individual papers discuss the applications of radioisotope techniques in the study of metals and alloys, problems of friction and lubrication, metal cutting, engine performance, and defects in metals. Several papers are devoted to the use of radioisotopes in the automation of industrial processes, recording and measuring devices, quality control, flowmeters, level gauges, safety devices, radiation counters, etc. These papers represent contributions of various Soviet institutes and laboratories. They were published as Transactions of the All-Union Conference on the Use of Radioactive and Stable Isotopes and Radiation in the National Economy and Science, April 4-12, 1957. No personalities are mentioned. References are given at the end of most of the papers.

Vedernikov, A.N. (Kazanskiy aviatsionnyy institut — Kazan' Aviation Institute). Certain Problems in the Preparation of Beta Emitters for the Elimination of Electrostatic Charges 292

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Pakidov, I.G., and A.Ye. Buzynov (Institut fiziki Ural'skogo filiala AN SSSR — Institute of Physics, Ural Branch, Academy of Sciences, USSR). Defectoscopy of Very Thick Steel Products 334

Grigor'yev, K.N., and I.G. Pakidov (Uralvagonzavod i Institut fiziki metallov Ural'skogo filiala Akademii nauk SSSR — Uralvagonzavod and the Institute of the Physics of Metals, Ural Branch, Academy of Sciences, USSR). Characteristics of Gamma Control and Radioscopic Technique for Complex Weldments 339

Grazhdankina, N.P., and I. G. Pakidov (Institut fiziki metallov Ural'skogo filiala AN SSSR — Institute of the Physics of Metals, Ural Branch, Academy of Sciences, USSR). Study of the Blurring of Images of Defects During the Co^{60} Gamma Radioscopy of Steel 348

Fakidov, I. G.

AUTHORS: Verbovenko, P. K., Fakidov, I. G. 89-2-27/35

TITLE: Concerning the Problem of Gamma-Ray Logging (K voprosu o gamma-gamma-karotazhe).

PERIODICAL: Atomnaya Energiya, 1958, 4 Nr 2, pp. 210-211 (USSR)

ABSTRACT: The logging is done by measuring the decrease in intensity of a point source in dependence on the density of the material bored. This function $J = J(\varrho)$ according to reference 2 has the form

$$J = \frac{Q}{780\pi} \varrho^2 \frac{e^{-\varrho \frac{R}{7\pi}}}{R} \qquad 1)$$

where Q is the intensity of source; R denoting the distance between source and detector; ϱ - the density of the medium scattering the gamma-rays. In the work mentioned in reference 3 the following function is given: $J \sim \varrho/1e^{-0,06\varrho l}$ 2)

From calculations by the author and comparisons with the experimental values the following formula was found:

$$J = k\varrho^{\frac{1}{2}} e^{-\lambda\varrho} \qquad 3)$$

k and λ denoting constants of the probe which are not dependent on the intensity of the gamma-source. Formulae 1) and 2) can

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Concerning the Problem of Gamma-Ray Logging. 89-2-27/35

only be used for calculations of intensity in the case of large probes, formula 2) being less sensitive toward the limitation of diffusion R > L. Formula 3) can be used for large as well as for small probes.
There are 1 figure and 3 Slavic references.

SUBMITTED: August 10, 1957

AVAILABLE: Library of Congress

Card 2/2 1. Gamma rays-Measurement 2. Gamma rays-Intensity

SOV/126-6-1-8/33

AUTHORS: Fakidov, I. G. and Grazhdankina, N. P.

TITLE: The Physical Properties of Cr-Ge Alloys. I. (Issledovaniye fizicheskikh svoystv splavov khrom-germaniy. 1)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 1, pp 67-73 (USSR)

ABSTRACT: This experimental paper deals with the electrical resistance (variation with temperature and magnetic field) at compositions of from 50 to 98 at.% Ge. The observed ferromagnetism is concluded to be due to $CrGe_3$ only. The first section of the paper is a general survey of ferromagnetism in alloys and related topics. Table 1 gives the properties in tabular form, for 273°K; Figs. 1-5 give more extensive data of the same general type. The results are discussed in relation to possible phases that may exist in the system; at 5.0 - 75 at.% Ge the phases are CrGe and $CrGe_3$, at 75-98 at.% Ge they are $CrGe_3$ + a solid solution of $CrGe_3$ in Ge. Fig.6, a, b, and c, represents etch figures (HNO_3, 1:1) for alloys containing 60, 66 and 90 at.% Ge. The figures agree in a general way with the deduction to be made from fig. 1.

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ASSOCIATION: Inst. of Metal Physics, Ural Branch, Acad. Sci. USSR

AUTHORS: Fakidov, I. G. and Afanas'yev, A. Ya. SOV/126-6-1-27/33

TITLE: The Electrical Conductivity of the Antiferromagnetic Cr-Sb compound (Ob elektroprovodnosti antiferromagnitnogo soyedineniya khrom-sur'ma)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 1, pp 176-177 (USSR)

ABSTRACT: The first half of this short letter discusses the general properties of the system in relation to published data. The preparation of the materials is then described (fusion at 1000-1100°C in a high-frequency furnace for several hours using KCl, NaCl or $CaCl_2$ as fluxes). Product 29.67% Cr (stoichiometric 29.93%[2]). Fig.1 shows the resistance-temperature curve (the only real result in the paper). The paper concludes with a discussion of antiferromagnetics as insulators or otherwise. The galvanomagnetic properties of the compound are stated to be under study, The Neel temperature is 425 5 C.

ASSOCIATION: Inst. of Metal Physics, Ural Brnach, Acad. Sci. USSR, ; Sverdlovsk State Pedagogic Inst.

AUTHORS: Fakidov, I. G. and Zavadskiy, E. A. SOV/126-6-3-28/32

TITLE: Generation of Super-intensive Magnetic Field Pulses (Polucheniye sverkhsil'nykh impul'snykh magnitnykh poley)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 3, p 569 (USSR)

ABSTRACT: In 1929, Academician P. L. Kapitza managed to obtain magnetic surge fields with potentials of up to 3 600 000 Oe and utilised them for studying the galvanometric properties of a large number of metals and some semi-conductors. Earlier, the same author produced a field with a potential of the order of 500 000 Oe in a coil of 1 mm dia. by discharging a powerful battery (Ref 1). The interest in phenomena relating to the influence of strong magnetic fields on the physical properties of metals and semi-conductors has considerably increased since that time. Developments in theoretical physics in recent years led to the conclusion that investigation of the magnetic and galvanometric properties of solid bodies in the field of intensive and super-intensive magnetic fields can yield important information on the shape and topology of energy surfaces of conductivity

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Generation of Super-intensive Magnetic Field Pulses SOV/126-6-3-28/32

electrons (Ref 2). In the laboratory of electric phenomena of the Institute of Metal Physics, Ural Branch, Ac.Sc. USSR a test rig is at present in operation for generating strong magnetic fields using short current pulses obtained by discharging a condenser battery of 1600 μF capacity charged to a potential of 3000 V. The discharge of the condenser battery through a coil is periodic with a frequency of 2800 to 3000 c.p.s. and a damping decrement Δ = 3 to 5.5, depending on the number of turns of the coil. This set-up permits generating inside a single-layer coil a magnetic field with a potential of over 500 000 Oe with a degree of uniformity of up to 1.5% inside a cylinder of 6.5 mm dia. and a height of 5 mm (it is mentioned in a footnote that the authors have succeeded in raising this potential up to 700 000 Oe). In Fig.1 an oscillogram is reproduced which shows the dependence on time of the potential of the magnetic field. The authors measured the dependence

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SOV/126-6-3-28/32

Generation of Super-intensive Magnetic Field Pulses

of the electric conductivity of n and p-type germanium at a high frequency (ρ = 54 Ohm·cm, ρ = 58 Ohm·cm) on the transverse magnetic field for T = 300, 77 and 20°K. It was established that $\Delta R_1/R$ of n-type germanium (ρ = 54 Ohm·cm) at T = 20°K is subjected to fluctuations. The results of these measurements and a detailed description of the set-up for measuring intensive magnetic fields will be published in later work.

Acknowledgments are made to N. V. Volkenshteyn for supplying the liquid hydrogen and to K. I. Davidenko for carrying out the measurements.

There are 1 figure and 6 references, 1 of which is Soviet, 5 English.

(Note: This is a complete translation)

Inst. Metal Physics Ural Branch, AS USSR

Card ~~3/4~~

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000412410004-5"

SOV/32-24-8-25/43

AUTHORS: Buzynov, A. Ye., Mochalov, N. D., Zakidov, I. G.

TITLE: Graphs of the Exposure and Detection of Defects Using Gamma Radiation in Betatrons (Grafiki eksponitsiy v betatronnoy gamma-defektoskopii)

PERIODICAL: Zavodskaya Laboratoriya, 1958, Vol. 24, Nr 8, pp. 986-988 (USSR)

ABSTRACT: Papers by foreign authors are listed and graphs are given for the γ-radiation in betatrons with various limiting energies of the photons. An evaluation of the data given in these papers indicates that some difficulties exist, since no coefficients are given to convert the sensitivity values, and the **Soviet films have** different sensitivities. For this reason and because of other considerations the experiments reported in this paper used domestic Roentgen films. The procedure used and resulting graphs are given. The graphs obtained in this work were different from those obtained by the foreign authors in that the Russian curves for a radiation energy of 22 MeV were S-shaped and thus gave a more accurate determination of the dosage. A. N. Orlov, N. F. Grazhdankina and I. G. Zakidov (Ref 13) found that in irradiating the photoemulsion

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SOV/[illegible]-24-5-25/43

Graphs of the Exposure and Detection of Defects Using Gamma Radiation in Betatrons

[illegible] γ-quanta there exists a lower critical density, which permits the smallest defects to be detected. In the work of the present paper it was observed that a similar result is obtained using harder γ-radiation. A. D. Yekhlakov and Z. A. Motova participated in the work of this paper. There are 3 figures, 1 table, and 14 references, 3 of which are Soviet.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute for the Physics of Metals, AS USSR)

Card [illegible]

AUTHORS: Fakidov, I. G., Zavadskiy, E. A. 56-34-4-56/60

TITLE: Oscillations of the Electric Resistance of n-Type Germanium in Strong Pulse-Like Magnetic Fields (Ostsillyatsiya elektricheskogo soprotivleniya germaniya n-tipa v sil'nykh impul'snykh magnitnykh polyakh)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 34, Nr 4, pp. 1036 - 1037 (USSR)

ABSTRACT: The authors investigated the change of the electric resistance of 3 monocrystalline germanium samples of the n-type in a transversal pulse-like magnetic field with an intensity up to 120 000 Gauss at temperatures of 300,77 and 20°K. The magnetic field was produced by means of the discharge of a condenser bank by a solenoid, and in the opening of that solenoid a Dewar flask containing the sample was put up. The germanium samples were of different degrees of purity. In magnetic fields of 25 000 - 120 000 Gauss and at T = 300°K $\Delta R/R_0$ depends linearly on the field intensity in the case of all 3 samples, the 3 angles of gradient of the line are given. At 77°K and in the same interval of the field intensities the linear dependence holds only for 2

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samples. In the third sample that dependence has a curved character with a tendency to saturation. The change of the $\Delta R/R_o$ of the sample number 1 (specific resistance ρ = 54 Ω cm) was also investigated at 20°K in the case of field intensities up to 110 000 Gauss. It is interesting that in such a case the resistance of the sample decreases instead of increasing as usual. But in the case of a reduction of the amplitude to zero the resistance of the sample returns to its original value. Besides this fact in the case of such germanium samples of the n-type an oscillation of the electric resistance in the interval of the electric field intensities of 25 000 - 110 000 Gauss was observed. The period of that oscillation is 0,10 Kilogauss and its maximum amplitude H = 55 000 Gauss. The author points to different previous works, dealing with the same subject. Data on details of the experiments and on the devices for the production of strong magnetic fields will be published in a later paper. There are 1 figure and 5 references, 1 of which is Soviet.

Inst. Metal Physics, Ural Br. AS USSR

APPROVED FOR RELEASE: 03/13/2001 CIA-RDP86-00513R000412410004-5"

SOV/126-7-1-26/28

AUTHORS: Fakidov, I.G. and Krasovskiy, V.P.

TITLE: Electrical Conductivity of Manganese Phosphides (Elektroprovodnost' fosfidov margantsa)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol 7, Nr 1, pp 156-157 (USSR)

ABSTRACT: The author studied the temperature dependences of the electrical resistance of Mn-P alloys with 33-53 at.% of P. These alloys were prepared from electrolytic manganese which was purified by sublimation, and from 99.9% pure red phosphor. The preparation of these alloys followed the technique described by Wiechmann (Ref.3). The following five alloys were studied: Mn_2P (33 at.% of P), Mn_2P + MnP (40 at.% of P), MnP + Mn_2P (46 at.% of P), MnP (50 at.% of P) and an alloy with 53 at.% of P. All these alloys were ferromagnetic. The samples were in the form of plane parallel plates. Their electrical resistance was measured by means of a d.c. potentiometer. The resistivities are given in a table on p 156 (in ohm.cm).

Card 1/2 Fig.1 gives the temperature dependences of the electrical

Electrical Conductivity of Manganese Phosphides SOV/126-7-1-26/28

resistance of Mn_2P and MnP between 77 and 370°K. The curves shown in Fig.1 and the curves obtained for the other three alloys all have a break at 22°C. This break is similar to that observed in ferromagnetics on passing through the Curie point. The authors conclude that in fact there is a Curie point at 22°C. There is 1 figure, 1 table and 4 references, of which 2 are French, 1 German and 1 Soviet.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics, Ac.Sc. USSR)

SUBMITTED: March 4, 1958

Card 2/2

SOV/126-7-1-27/28

AUTHORS: Margolin, S.D. and Fakidov, I.G.

TITLE: Magnetic Studies of the Manganese-Germanium Alloys (Magnitnyye issledovaniya splavov sistemy marganets-germaniy)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol 7, Nr 1, pp 157-159 (USSR)

ABSTRACT: The authors reported earlier (Ref.1) that an alloy with 30 at.% of Mn and 70 at.% of Ge has two ferromagnetic transition points between 77 and 398°K in fields from 20 to 2400 Oe. One of these transitions occurs at 283°K and the other at 148°K in fields of 38 Oe and at 130°K in fields of 2432 Oe. The maximum of magnetization occurs at 173°K at all field intensities. The authors' work showed that the ferromagnetic state of the Mn-Ge alloys is due to Mn_3Ge_2 only. To elucidate the nature of these two ferro-

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magnetic transition points the authors continued their investigations of the 30-70 Mn-Ge alloy as well as extending their studies to samples with higher amounts of germanium. It was found that all these alloys consisted of only two phases: a compound Mn_3Ge_2 and pure germanium. Some of the results are given in Figs. 1 and 2. Fig.1 shows the dependence of the coercive force H_c, magnetization I and remanent magnetization I_r on the applied magnetic field H_1 for the 30-70 Mn-Ge alloy. Fig.2 gives the temperature dependence of the magnetization and coercive force of the 30-70 Mn-Ge alloy on heating (circles) and cooling (crosses). From Figs. 1, 2 and other results the authors draw the following conclusions.

 (1) The Mn-Ge alloys with 40 at.% of Ge or more

have two ferromagnetic transition points. The true ferromagnetic Curie point in these alloys is 283°K, and it is confirmed by the alloys obeying the Curie-Weiss law above 280°K.

(2) The low-temperature ferromagnetic transition point is a phase transition of the first type. This is confirmed by thermograms obtained using Kurlakov's pyrometer which indicated a transition at 113°K with a latent heat of transition. It is also supported by the temperature dependences of magnetization which are not single-valued and depend on whether the sample is heated or cooled (Fig.2). On cooling of a 30-70 Mn-Ge sample in a magnetic field of 2432 Oe the transition temperature is 118°K, while on heating the same transition occurs at 130°K.

(3) It is possible that the anomalous behaviour of temperature dependence of the magnetization of the Mn-Ge

Magnetic Studies of the Manganese-Germanium Alloys SOV/126-7-1-27/28

alloys could be explained using Dzyaloshinskiy's theory (Ref.5). Acknowledgments are made to K.B. Vlasov for his advice. There are 2 figures and 9 references, of which 5 are Soviet, 1 German, 2 English and 1 French.

ASSOCIATION: Institut fiziki metallov AN SSSR (Physics of Metals Institute, Ac.Sc. USSR)

SUBMITTED: February 25, 1958

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24(3)

SOV/126-7-2-28/39

AUTHORS: Fakidov, I. G. and Krasovskiy, V. P.

TITLE: Galvanomagnetic Properties of Manganese Phosphides (Gal'vanomagnitnyye svoystva fosfidov margantsa)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol 7, Nr 2, pp 302-304 (USSR)

ABSTRACT: The authors studied the Hall effect and magneto-resistance of Mn-P alloys, with 33-53 at.% of P. These properties were studied in order to obtain information about the energy spectrum and density of current carriers, and to elucidate the effect of magnetic fields on the magnetic transition temperature, reported by Guilland (Ref 1). The galvanomagnetic properties were measured on samples in the form of 11 x 5 x 0.8 mm plates. All measurements were carried out by the d.c. potentiometric method. The Hall effect was measured on samples with 33 at.% P (Mn_2P), 40 at.% P (Mn_2P + MnP), 46 at.% P (MnP + Mn_2P), 50 at.% P (MnP). The sign of the Hall effect was positive in all the alloys studied, confirming the hole mechanism of conductivity. Thermoelectric power also indicated the positive sign of current carriers. The Hall e.m.f. in a ferromagnetic may be represented in the

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Galvanomagnetic Properties of Manganese Phosphides

form $E = R_o H + R_f I$, where R_o is the ordinary Hall effect constant, H is the magnetic field intensity, R_f is the extraordinary Hall effect contant, and I is the magnetization. The value of R_o is related to the current-carrier density (Ref 4) and, therefore, this density can be found from measurement of the Hall effect at temperatures sufficiently far from the ferromagnetic Curie point. The authors measured the Hall effect at 77°K, and the results are shown in the form of the Hall e.m.f. per unit length between the electrodes and per unit current density in Fig 1. The results of Fig 1 refer to the 50 at.% alloy (MnP) for which the value of R_o was found to be 3×10^{-4} cm^3/coulomb. Assuming that only holes exist in manganese phosphide, their density n was found from $R_o = 1/ne$ (e is the hole charge). The value of n deduced in this way was 2×10^{22} cm^{-3}. The $E = E(H)$ curves taken below and above the Curie point show that the Hall e.m.f. is a linear function of magnetization. The extraordinary Hall effect constant was found to decrease with temperature, in agreement with the Karplus-Luttinger

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Galvanomagnetic Properties of Manganese Phosphides

relationship (Ref 5) $R_f \sim \rho^k$, where ρ is the electrical resistivity and k is an integer. The effect of transverse and longitudinal magnetic fields on electrical resistance of Mn-P alloys was measured on the same samples which were used in the Hall effect studies. The sign of $\Delta R/R$ was negative in both transverse and longitudinal fields. The results of measurements exhibited the characteristics of even effects in the para-process region. According to Akulov (Ref 6), $\Delta R/R = aH^{2/3}$ at the Curie point, $\Delta R/R = cH$ below the Curie point, and $\Delta R/R = bH^2$ above the Curie point. These relationships are well obeyed; for example, for 50 at.% (MnP) alloy $a = 1.4 \times 10^{-5}$ at 21°C, $b + 5 \times 10^{-12}$ at 55°C, and $c = 3.5 \times 10^{-7}$ at 4.5°C. The value of $\Delta R/R$ reaches its maximum, which is of the order of 1% for MnP, at 22°C (Fig 2) and this temperature is not affected by the composition of the alloy or the applied magnetic field. The temperature at which the maximum of $\Delta R/R$ occurs coincides with the temperature of a break in the curves of electrical resistivity. $\Delta R/R$ is practically the same in longitudinal and transverse fields; the small

Card 3/4 differences between the longitudinal and transverse effects

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Galvanomagnetic Properties of Manganese Phosphides

are due to changes of resistance in magnetic fields which occur in all substances and increase quadratically with the magnetic field. At the liquid-nitrogen temperature the change of resistance on application of a magnetic field is much smaller than at room temperature. This is due to the small contribution of the para-process which is negligible at the liquid-nitrogen temperature. There are 2 figures and 6 references, 2 of which are Soviet, 2 English, 1 German and 1 French.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics, Ac.Sc. USSR)

SUBMITTED: March 4, 1958

Card 4/4

24(3) · SOV/126-7-2-29/39

AUTHORS: Vasil'yeva, I. N., Novogrudskiy, V. N., Samokhvalov, A.A. and Fakidov, I. G.

TITLE: The Hall Effect in the Mn-Sb System (Effekt Kholla v sisteme Mn-Sb)

PERIODICAL: Fizika Metallov i Metallovedeniye, 1959, Vol 7, Nr 2, pp 304-305 (USSR)

ABSTRACT: Electrical and magnetic properties of alloys are often used when the state (phase) diagram is constructed. Although galvanomagnetic properties are more structure-sensitive than electrical and magnetic properties, the former are rarely used in the construction of phase diagrams. The present paper reports measurements of the Hall effect in the two-phase system Mn-Sb as a function of composition. According to the phase diagram (Refs 1,2) the Mn-Sb alloys are a two-phase system in the region of Mn concentrations from 0 to 50 atomic %; this two-phase system consists of ferromagnetic MnSb and free antimony. These components form a eutectic at approximately 20 at.% Mn. Samples of Mn-Sb alloys were prepared by melting together fine, well-mixed powders of Mn (99.8% purity) and Sb (99.88% purity) in evacuated quartz ampoules.

The Hall Effect in the Mn-Sb System SOV/126-7-2-29/39

The authors studied alloys containing 15.2, 20.2, 28.0, 31.7, 44.0 and 49.6 at.% of Mn. The phase composition of samples was checked by metallographic examination. It was found that the phase composition of the alloys produced by the authors is identical with the phase composition of the alloys described by Murakami and Hatta (Ref 2). Measurements of the Hall effect were made, using Düsselhorst's compensator and a galvanometer with a sensitivity of 4×10^{-8}V per division. Fig 1 shows the dependence of the Hall e.m.f. on the applied magnetic field intensity for samples of alloys of compositions listed above (curves 2-7) and of pure antimony (curve 1). Fig 1 shows that the Hall effect curves have the usual form for ferromagnetics. With increase of the amount of antimony in the alloy, the Hall e.m.f. increases and the curves shown in Fig 1 become more linear. Dependences of the "ordinary" component of the Hall constant R_o (which is proportional to the magnetic field intensity) and of the Hall constant R_f of the ferromagnetic phase (which is proportional to

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magnetization of the sample) on composition are shown in Fig 2. R_o is seen to depend linearly on the amount of manganese except in the region of the eutectic composition, where it has a minimum. The other Hall constant, R_f increases with increase of the manganese content following a near-quadratic law. From the experimental data reported in the present paper, it is concluded that the Hall constant R_o is a sensitive indicator of the eutectic point in the Sb-MnSb system. Measurements of the magnetic (Ref 3) and electrical properties of the Mn-Sb alloys and of changes of electrical resistance in a magnetic field did not show any peculiarities at the eutectic point. This means that the Hall constant R_o is a more sensitive indicator of the phase composition than the properties just listed. There are 2 figures and 3 references, 2 of which are German and 1 Japanese.

(Note: This is an abridged translation)

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics, Ac.Sc., USSR)

SUBMITTED: October 28, 1957

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SOV/126-7-3-35/44

AUTHORS: Samokhvalov, A. A. and Fakidov, I. G.

TITLE: Thermoelectric Properties of a Monocrystal of Magnetite in the Low Temperature Transformation Range (Termoelektricheskiye svoystva monokristalla magnetita v oblasti nizkotemperaturnogo prevrashcheniya)

PERIODICAL: Fizika metallov i metallovedeniye, Vol 7, Nr 3, pp 465-467 (USSR) 1959.

ABSTRACT: Magnetite undergoes a transformation at approximately 114°K the nature of which is not yet clear. At this temperature anomalies in thermal (Refs.1, 2), magnetic (Refs.3, 4), electrical (Ref.4), galvanomagnetic (Refs.4, 5) and other properties (Refs.6, 7) are observed. The aim of the present work was to study the temperature dependence of the thermoelectric properties of magnetite in the low temperature transformation range, as well as at higher temperatures up to 400°K. The thermo-e.m.f. of magnetite was measured on six monocrystal specimens of natural magnetite. The specimens 1, 3, 4 and 6 were cut out from one octahedral magnetite monocrystal, and the specimens 2 and 5 from two other magnetite monocrystals. All specimens had the shape

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Thermoelectric Properties of a Monocrystal of Magnetite in the Low Temperature Transformation Range

of plates, 8.15 x 5.60 x 2.15 mm (specimen 4), and 9.20 x 7.00 x 2.10 mm (specimen 6). The other specimens had approximately the same dimensions. The measurements were carried out at temperatures ranging from that of liquid nitrogen to 400°K in a cryostat similar to that described by Zavaritskiy (Ref.12). A thermal gradient was created in the specimens by a furnace on a copper block to which the specimens were welded. The temperature of the joints was measured by a copper-constantan thermocouple by a compensation method. The result of thermo-e.m.f. measurement in the magnetite monocrystal (specimen 1) in the range 90 - 400°K is shown in Fig.1. In this range the thermo-e.m.f. has a negative sign which is due to electronic conductivity in the magnetite. Fig.2 shows the results of parallel thermo-e.m.f. and electrical resistance measurement of magnetite (specimen 6) in the low temperature transformation range in relation to temperature. Along the ordinate axis α and $\ln\rho$ are plotted as a function of $(10^7/T)$. The results obtained for the temperature dependence of the thermo-e.m.f. coefficient cannot be explained on the basis of the zone

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SOV/126-7-3-35/44

Thermoelectric Properties of a Monocrystal of Magnetite in the Low Temperature Transformation Range

theory for semiconductors because of the low mobility of the electric current carriers (Ref.11) and of the mechanism of electroconductivity of magnetite (Ref.8) which is different from that of the usual semiconducturs. The authors arrived at the following conclusions:

1. The temperature dependence of the thermo-e.m.f. coefficient of magnetite has a maximum in the low temperature transformation range at a temperature of 95 ±0.5°K.
2. The position of the maximum of the thermo-e.m.f. coefficient coincides with the deviation at B of the curve $\ln \rho(1/T)$ on entering the range below the transformation range.
3. These results, as well as those obtained by other workers (Refs.1-10) show that the low temperature transformation in a magnetite monocrystal which is associated with electron ordering occurs over a considerable temperature range.

There are 2 figures and 12 references, of which 3 are Soviet, 7 English, 1 Japanese and 1 German.

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SOV/126-7-3-42/44

AUTHORS: Krasovskiy, V. P. and Fakidov, I. G.

TITLE: Thermoelectrical Properties of Manganese Phosphides (Termoelektricheskiye svoystva fosfidov margantsa)

PERIODICAL: Fizika metallov i metallovedeniye, Vol 7, Nr 3, pp 477-478 (USSR) 1959

ABSTRACT: Slightly Abridged Translation

1. Manganese-phosphorus alloys containing from 27.5 at.% P upwards exhibit ferromagnetic properties at below 25°C, according to Guillaud (Ref.1). In the vicinity of that temperature a magnetic transformation occurs in these alloys, the temperature of which depends, to a large extent, on the magnetic field strength. However, investigations carried out by the authors of this paper into the electrical conductivity and galvanomagnetic effects of manganese-phosphorus alloys in the concentration range of 33 to 53 at.% P have shown that the temperature of the magnetic transformation is independent of the magnetic field strength of these alloys. The Curie point in an MnP alloy, according to electrical and magnetic measurements, was found to be 22°C.

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SOV/126-7-3-42/44

Thermoelectrical Properties of Manganese Phosphides

2. Manganese volatilized in vacuum and red phosphorus (99.9%) were used for the manufacture of the alloys. The alloys were made by heating a mixture of manganese and phosphorus powders in evacuated quartz ampoules at 650°C. In order to obtain the alloys in equilibrium condition the ampoules were kept in the furnace at the above temperature for 50 hours. The alloys were then furnace cooled to room temperature. The alloys thus obtained were chemically analysed in order to determine the manganese content, and were also submitted to an X-ray phase analysis. Test specimens were cut out by means of an abrasive wheel and subsequently ground. The length of the specimens was 8-12 mm, width 3-5 mm and the thickness 0.6-1.5 mm. The thermo-e.m.f. was measured at temperatures ranging between that of boiling nitrogen and +100°C. A temperature difference of 10-15°C was brought about between the ends of the specimen by means of a small heater. The junction of two identical copper-constantan thermocouples was firmly pressed against the sides of the specimen. The thermal-e.m.f. of the specimen was measured in relation to copper by a compensation apparatus having a sensitivity of 10^{-7} v/mm. The accuracy of the

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Thermoelectrical Properties of Manganese Phosphides

measurements of the thermal-e.m.f coefficient α was 10%.

3. Two manganese-phosphorus alloys were investigated: one containing 40 at.% P and the other 46 at.% P. Both alloys are two-phased, consisting of the phases MnP and Mn_2P. The results of measurement of the temperature dependence of the thermal-e.m.f. coefficient between - 180 and + 100°C for the above alloys are shown in Fig.1. From the graph it can be seen that the nature of the temperature dependence of α for both alloys is identical. In the temperature range - 180 to - 50°C α decreases with increase in temperature, has a minimum at around - 50°C and then increases. At a temperature of above - 50°C the thermo-electrical properties of the alloys correlate with the results of electrical conductivity measurements (see Fig.2). The metallic nature of the electrical conductivity indicates a small thermal-e.m.f. value ($\alpha <$ μv/deg.) and its temperature dependence, i.e. the value of α, is proportional to the temperature. The behaviour of α at below - 50°C is anomalous and cannot be correlated with the electrical conductivity measurements.

Card 3/4 The reason for the nature of such a dependence of $\alpha(t)$ of

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SOV/126-7-3-42/44

Thermoelectrical Properties of Manganese Phosphides

manganese-phosphorus alloys is not yet understood. The positive sign of the thermo-e.m.f. corresponds with the Hall constant sign and testifies as to the hole mechanism of conductivity. It appears that the manganese phosphides investigated have a conductivity zone which is heavily populated by electrons.

There are 2 figures and 4 references, of which 1 is Soviet and 3 French.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics of Metals, Ac. Sc., USSR)

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SUBMITTED: July 16, 1958

Card 4/4

AUTHORS: Fakidov, I.G. and Zavadskiy, E.A. SOV/126-7-4-24/26

TITLE: An Induction Method of Measuring the Hall Effect in Strong Pulsed Magnetic Fields

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 4, pp 637-638 (USSR)

ABSTRACT: In the classical method of measuring the Hall effect a primary current from an external source is passed through a sample in a magnetic field. If the magnetic field is not constant, currents induced in the sample may be used instead of the primary current. A method using varying magnetic fields to measure the Hall constant was first described by Busch et al (Ref 1); they used currents induced on switching on or off of a d.c. electromagnet. The present authors describe an application of the Busch method to strong periodic pulsed magnetic fields and materials of high resistivity such as semiconductors. A sample in the form of a disc of radius r_o was placed in a coil at right-angles to magnetic force lines (Fig 1). The varying magnetic field induced currents in the disc. For samples of high-resistivity material in the form of thin discs, the surface effects and the

An Induction Method of Measuring the Hall Effect in Strong Pulsed Magnetic Fields

demagnetizing action of induced currents may be neglected. Since the applied magnetic field is of damped oscillatory nature the magnetic induction is given by

$$B = B_m e^{-bt} \sin \omega t \qquad (4)$$

where $b = \delta/T$, δ is the logarithmic decrement and T is the time period. The value of the Hall emf between the centre of the disc and its periphery, at the moment of the first maximum $B_{m_1} = B_m \exp(-\delta/4)$ of the magnetic induction, is given by

$$V_{x_1} = -AR\sigma r_o^2 \omega B_{m_1}^2, \text{ where } A = \frac{1}{8} e^{\delta/4}(1 - \tan \varphi),$$

R is the Hall constant, $\tan \varphi = b/\omega$, ω is the angular frequency, σ is the electrical conductivity of the sample. The relationship obtained here was checked on a germanium disc of 11 mm diameter, 1 mm thickness in magnetic fields up to 120 kilogauss and $\omega = 16000 \text{ sec}^{-1}$. The calculated values of the Hall constant R were compared with the results of measurements on a plate of

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An Induction Method of Measuring the Hall Effect in Strong Pulsed Magnetic Fields

the same material; the two sets of results agreed satisfactorily. The method can be used also for undamped alternating magnetic fields. Then $b = 0$ and $\varphi = 0$ and the Hall emf between the centre of the disc and its periphery is given by

$$V_x = -\frac{1}{8} R\sigma r_0^2 \omega B_m^2 \sin 2\omega t \qquad (9)$$

In low-frequency magnetic fields and for thin discs the relationships obtained by the authors are also valid for metals. There is 1 figure and 1 Swiss reference.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Metal Physics Institute, AS USSR)

SUBMITTED: December 4, 1958

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SOV/126- - -7-5-8/25

AUTHORS: Fakidov, I.G. and Tsiovkin, Yu.N.

TITLE: Magnetic Properties of the Compound Mn_3Ge_2 (Magnitnyye svoystva soyedineniya Mn_3Ge_2)

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 5, pp 685-688 (USSR)

ABSTRACT: The authors studied magnetic properties of Mn--Ge alloys containing from 40 to 95 atomic % of Ge. The properties studied were: the temperature dependence of the magnetic moment between 77 and 750 °K and the dependence of the magnetic moment on the alloy composition and the magnetic field intensity. Purity of the original materials and the method of preparation of alloys were described earlier (Ref 4). Measurements were carried out on a magnetic balance using Faraday's method. Some of the results obtained are shown in Figs 1-4. Fig 1 gives the dependence of magnetic susceptibility of Mn--Ge alloys on composition at 420 °C. Fig 2 shows the temperature dependence of susceptibility of the ferromagnetic phase Mn_3Ge_2 in alloys containing 60, 70, 80 and 95 atomic % of germanium. The temperature and the magnetic field dependences of the magnetic moment of

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SOV/126- - -7-5-8/25

Magnetic Properties of the Compound Mn_3Ge_2

Mn_3Ge_2 are given in Figs 3 and 4 respectively. From their results the authors draw the following conclusions: (1) In Mn—Ge alloys containing from 40 to 95 atomic % of Ge a ferromagnetic phase of Mn_3Ge_2 composition is present. This phase exists between 113 and 283 °K. At 113 °K a phase transition of the first kind occurs, while 283 °K is the ferromagnetic Curie point. The paramagnetic Curie point of Mn_3Ge_2 lies at 300 °K. The magnetic moment of the manganese atom in the compound Mn_3Ge_2 is 2.5 μB (found from paramagnetic measurements). (2) Values of the electrical resistivity ($\sim 10^{-3}$ ohm.cm) and the magnetic moment (2.5 μB) indicate that the metallic bond predominates in the compound Mn_3Ge_2. There are 4 figures, 1 table and 7 references, of which 3 are Soviet, 3 German and 1 French.

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ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics, Ac. Sc. USSR)

SUBMITTED: March 4, 1958

SOV/126-7-6-16/24

AUTHORS: Novogrudskiy, V. N. and Fakidov, I. G.

TITLE: Determination of the Sign of the E.M.F. for Individual Micro-Crystals on Polished Sections with the Aid of a PMT-3 Microhardness Meter

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 7, Nr 6, pp 903-905 (USSR)

ABSTRACT: The determination of the sign of the current carrier in an alloy requires emf determination for each phase separately. Boltaks and Zhuze (Ref 1) used a probe moved by a micrometer screw under the microscope objective at a magnification of 20. This method is not satisfactory at high magnifications and the present authors have adapted a type PMT-3 microhardness meter for this purpose. The diamond tip was replaced by a tungsten needle in a suitable mounting with its tip sharpened electrolytically to a thickness of 6-10 microns and fitted with a constantan-wire resistance heater (Fig 1). The load was 0.5-3 g. With very hard specimens an auxiliary polished section of aluminium in the focus of the microscope together with the specimen had to be used for centering the instrument. The technique was checked on Mn-Sb alloys,

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Dêtermination of the Sign of the E.M.F. for Individual Micro-Crystals on Polished Sections with the Aid of a PMT-3 Microhardness Meter

which contain free Sb and Mn when the Mn content is below 50 and over 70 at.%, respectively. The signs of the thermo-emf for these elements are known. These alloys also form a variety of structure with grain sizes covering a wide range. The tests showed the technique to be effective down to grain sizes of 6-10 microns, a magnification of 487 being preferable for grains under 12-14 microns.
There are 1 figure and 4 references, 2 of which are Soviet, 1 German and 1 Japanese.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Metal Physics, Ac.Sc., USSR)

SUBMITTED: May 21, 1958

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67687

SOV/126-8-4-9/22

24.7600

AUTHORS: Fakidov, I.G., and Zavadskiy, E.A.

TITLE: A Generator of Ultrahigh Pulsed Magnetic Fields

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 4, pp 562-568 (USSR)

ABSTRACT: The pulsed magnetic fields are obtained by discharging a bank of capacitors through special coils. Magnetic fields up to 700 000 oersted can be obtained in this way. A photograph of the apparatus is shown in Fig 1. Sixteen type IM-3/100 capacitors are employed so that 7200 joules can be stored at a nominal voltage of 3 kV. By reducing the resistance and the inductance of the discharge circuit it was possible to increase the percentage of energy used to produce the magnetic field to 17%. The coils can take currents up to 60 000 amp. A block diagram of the apparatus is shown in Fig 2. The bank of capacitors is charged from the high-voltage rectifier through the current limiting resistor R. The discharge takes place through the spherical discharger 3. If necessary, the circuit can be controlled automatically to produce the required current pulses. A drawing of one of the coils is given in Fig 4, and the

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A Generator of Ultrahigh Pulsed Magnetic Fields

corresponding magnetic field distribution for a coil with an internal diameter of 16 mm is shown in Fig 5. The magnetic field was measured with a search coil in conjunction with an RC integrator, and the calculated value of 700 000 oersted was confirmed experimentally. The ultrahigh pulsed magnetic fields are being used by the present authors in a study of galvanomagnetic phenomena and of the photogalvanomagnetic effect in various semiconductors. Magnetisation studies on ferrites are also being carried out. A similar apparatus has been built in the low-temperature laboratory of the Moscow State University Professor A.I. Shal'nikov, Corr. Memb. AS USSR. Acknowledgement is made to I.I. Kuntsevich and A.A. Teterin.

There are 6 figures, 2 tables and 7 references, of which 1 is French, 1 is Soviet and 5 are English.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics of Metals, Ac.Sc. USSR)

SUBMITTED: February 28, 1959

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67756

SOV/126-8-5-8/29

24.7600

AUTHORS: Samokhvalov, A.A., and Fakidov, I.G.

TITLE: Thermoelectric Properties of Magnetite in the 80-400 °K Temperature Range

PERIODICAL: Fizika metallov i metallovedeniye, Vol 8, 1959, Nr 5, pp 694-699 (USSR)

ABSTRACT: The present work is part of a series on the electrical properties of magnetite. It gives results of an investigation of the thermoelectric properties with the object of getting certain data on the energy spectrum of the conduction electrons and the low-temperature transformation in magnetite known (Refs 2,3,4,6,7,9) to lead to changes in many physical properties at about 118 °K. The thermo-e.m.f. was measured for six specimens of a natural-magnetite single crystal, Nrs 1, 3, 4 and 6 being cut from one large octahedral and Nrs 2 and 5 from two other single crystals, and for a polycrystalline specimen (Nr 7). All specimens were in the form of plates. For temperatures of 300-400 °K a thermostat was used; at and above the boiling temperature of liquid nitrogen a modification of the cryostat described by Zavaritskiy (Ref 15) was used

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Thermoelectric Properties of Magnetite in the 80-400 °K Temperature Range

(Fig 1). A more detailed view of the apparatus is shown in Fig 2; the single-crystal magnetite specimens were soldered to a copper block around which a heater (to produce the temperature difference) was wound, the whole then being placed in the gap in the top part of the cryostat tube. Junction temperatures were measured with copper-constantan couples. The relatively long polycrystalline specimen had the heater wound directly on it and was enclosed in a second heater which enabled the overall temperature to be adjusted. Temperature and thermo-e.m.f. were measured with a low-resistance potentiometer by the compensating method, preliminary experiments having shown (Fig 3) that the thermo e.m.f. coefficient was independent of temperature difference when this exceeded 1°C. The electrical resistance was also measured and, for some specimens, the temperature dependence of the initial magnetite permeability. The temperature coefficient of the thermo-e.m.f. for specimen Nr 1 was found to be relatively constant from 400 °K down to about 120 °K, reach a maximum at 95 ± 2 °K, and fall

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Thermoelectric Properties of Magnetite in the 80-400 °K Temperature Range

sharply at still lower temperatures (Fig 4). Fig 5 shows plots (specimen Nr 6) of the temperature coefficient and logarithm of resistivity against 10^3/absolute temperature: the position of the maximum temperature-coefficient (95°K) corresponds to a break in the logarithm curve, a further break occurring at 114 ± 2 °K. Similar correlations were obtained for the other specimens and the greatest change in their magnetic permeability was found at 109 ± 2 °K. The corresponding curves for the polycrystalline specimen (Nr 7) are shown in Fig 6. The logarithmic curve shown a break and not a jump, and the temperature-coefficient curve has no maximum or sudden change corresponding to the transformation. For all specimens the temperature coefficient fell sharply on cooling below the transformation temperature range. The rise in the value at the transformation temperature is attributed by the authors to deviations of the magnetite from stoichiometric composition. The authors use the relation between the temperature coefficient of the

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Thermoelectric Properties of Magnetite in the 80-400 °K Temperature Range

thermo-e.m.f. and entropy (Refs 1, 14) to try to obtain data on the chemical potential (Fermi level) of the conduction electrons. A graphical (Ref 13) solution of the equation showed that above 200 °K the chemical potential is positive, decreasing below this temperature and becoming negative at the low-temperature transformation temperature. These results confirm the authors' conclusions from studies of the Hall effect (Refs 12,16). Comparison of temperature-coefficient values with those of parallel resistivity determinations indicates that the anomalies associated with the low-temperature transformation persist at 14-15° below this temperature, which is confirmed by the authors' (Ref 17) work on the Nernst-Ettinghausen effect in magnetite.

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There are 6 figures and 17 references, of which 7 are Soviet, 7 English, 1 French, 1 Japanese and 1 in Acta Crystallographica.

ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics of Metals, Academy of Sciences USSR)

SUBMITTED: May 15, 1959

67658

SOV/126-8-6-5/24

24.7600

AUTHORS: Novogrudskiy, V.N., Samokhvalov, A.A. and Fakidov, I.G.

TITLE: On the Hall Effect in Ferromagnetics

PERIODICAL: Fizika metallov i metallovedeniye, 1959, Vol 8, Nr 6, pp 834-836 (USSR)

ABSTRACT: In spite of the fact that there exists a considerable amount of experimental material on the Hall effect in ferromagnetics, there is so far no final theory of this effect. The Hall effect is most frequently described by a formula of the form

$$E_x = R_0H + R_1M \quad (1)$$

where R_0 is the Hall constant for the "usual" part of the effect, R_1 is the Hall constant for the ferromagnetic part, H is the magnetic field strength inside the specimen and M is the magnetization of the specimen. Another way of describing this effect is by the use of the formula

$$E_x = R\,(H_0 + \alpha M) \quad (2)$$

Card 1/4 where $\alpha = R_1/R_0$. It is further assumed that the "usual"

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On the Hall Effect in Ferromagnetics

Hall constant is determined by the concentration of conduction electrons n. If current carriers of one sign only are present, R = 1/cen. The weak temperature dependence of R_0 in some ferromagnetic metals and alloys can be explained by taking into account the interaction between s and d electrons (Ref 7 and 8). However, there exists another approach in which the Hall effect in ferromagnetics is described by a formula of the form

$$E = R_1 M + R_i M_i \quad (3)$$

where R_1 and M have the same meaning as above and R_i is a Hall constant associated with the true magnetization of the ferromagnetic on saturation. According to this point of view, the constant R_i is associated with the appearance of a Hall emf due to a change in the spontaneous magnetization, and the constant R_i is not as simply related to the concentration of conduction electrons as is R_0. Experimental data confirm both of these points of view. It is known that the current carrier concentration calculated from the expression

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On the Hall Effect in Ferromagnetics

$R_0 = 1/cen$ gives $n \sim 10^{22} cm^{-3}$ (Ref 11). Experiments carried out on magnetite by the present authors (Ref 12) have shown that conduction electron concentration determined from the magnitude of R_0 is strongly dependent on temperature and its magnitude is in accordance with a semiconductor character of the electrical conductivity of magnetite. The value of the conduction electron concentration determined from the magnitude of R_0 is in agreement with the value obtained from measurements of the thermal emf in magnetite (Ref 13). On the other hand, Bazhanova (Ref 10) has confirmed experimentally the point of view expressed by Eq 3. In the opinion of the present authors, in the general case, the Hall effect in ferromagnetic metals and semiconductors must be described by a formula of the form

$$E_x = R_0 0 + R_1 M + R_i M_i \qquad (4)$$

where all the Hall constants and magnetic quantities have the same meaning as in the previous equations. Eq (4) is confirmed by all the existing data on the Hall effect at all temperatures. It is suggested that it will

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On the Hall Effect in Ferromagnetics

be desirable to have more detailed experimental data above and below the ferromagnetic transformation temperature in substances in which the three terms are comparable. There are 14 references, 7 of which are Soviet, 6 English and 1 German.

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ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics of Metals, AS USSR)

SUBMITTED: May 17, 1959

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S/058/61/000/004/017/042
A001/A101

24.2200 (1147, 1158 only)

AUTHORS: Fakidov, I.G., Vasil'yeva, J.M.

TITLE: Electric and galvanomagnetic properties of Mn-Sb alloys

PERIODICAL: Referativnyy zhurnal. Fizika, no 4, 1961, 315, abstract 4E424 ("Uch. zap. Sverdl. gos. ped. in-ta", 1959, no 17, 37 - 46)

TEXT: It was established that investigated substances can be classified as metals both in view of their absolute values of electric resistivity and their temperature dependence; in the temperature range from 77 to 400°K, they have a constant number of charge carriers whose energy is within the conductivity band. The latter fact is in agreement with theoretical concepts (RZhFiz, 1956, no 8, 23146) as well as with the experimental data that ferromagnetism in compounds of transition elements Cr and Mn with elements of the IV, V, and VI subgroups must be connected with the metallic state of the substance.

[Abstracter's note: Complete translation.]

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24(3) SOV/56-36-4-15/70

AUTHORS: Fakidov, I. G., Krasovskiy, V. P.

TITLE: The Magnetization and the Magnetocaloric Effect of Manganese Phosphide (Namagnichennost' i magnetokaloricheskiy effekt fosfida margantsa)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 4, pp 1063-1067 (USSR)

ABSTRACT: In the introduction the measurements and the theory of Guillaud (Refs 1-3) are discussed in short. Guillaud had shown that the temperature dependence of MnP at low temperatures follows the T^2-law. The magnetic moment of a manganese atom was determined as amounting to $1.2\mu_B$, and for the temperature of the magnetic transformation Θ_f Guillaud mentioned 25°C and expressed the opinion that Θ_f depends in a high degree on magnetic field strength. The authors of the present paper further investigated the magnetocaloric effect and the magnetization of MnP within the temperature range of Θ_f and at various values of H. Preparation of the sample as well as course and method of

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The Magnetization and the Magnetocaloric Effect of Manganese Phosphide

measurements are described. The results are shown by means of diagrams and are discussed. An investigation of the temperature dependence of the electric resistance $\varrho = \varrho(t)$ and the magnetocaloric effect $\Delta t(t)$ showed the characteristic salient point in the curve (cf family of curves figure 1 for H-values between 1000 and 15000 Oe) at 22°C. The nature of this salient point is similar to that of ferromagnetics passing through Curie point. Figure 2 shows the dependence of the caloric effect Δt on the square of magnetization σ for $0 < \sigma^2 < 2000$ in 2 diagrams. The families of curves have a shape that deviates slightly from that of a straight line. Finally, the temperature dependence of the spontaneous magnetization σ_s is investigated by the method developed by K. P. Belov (Refs 6-8). The method developed by Belov for ferromagnetic alloys and ferrites is called the "method of thermodynamic coefficients"; it is based upon evaluation of the curves of real magnetization by means of the thermodynamic equation $H = a\sigma + b\sigma^3$, where a and b are the thermodynamical coefficients. For $H = 0$ it is found that near Curie temperature $\sigma_s^2 = -a/b$, and it is possible to determine

Card 2/4 also the position of the Curie point by means of this equation,

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The Magnetization and the Magnetocaloric Effect of Manganese Phosphide

because for a = 0 it is true that $T = \Theta_f$. The results obtained by evaluation of measuring results with respect to the magnetization curve are shown by figure 3. Determination of the Curie point by employing the Belov-method gives the value of 21.1°C, which is in agreement with the value determined from the magnetocaloric effect. Contrary to Guillaud, the authors found that magnetic transformation temperature does not depend on magnetic field strength. In conclusion, the results obtained are discussed in short from the point of view of the s-d exchange model (Vonsovskiy, Vlasov, reference 10). The ξ-values (from $(\sigma_s/\sigma_0)^2 = \xi\,(1-T/\Theta)$) are approximately 3.4 (obtained according to data concerning the magnetocaloric effect) or approximately 3 (according to data obtained by employing the method of "curves of equal magnetization"), i.e. ξ corresponds approximately to the value obtained according to the "quasi-classical" theory of ferromagnetism. The authors thank K. B. Vlasov for letting them know the results obtained by his work and for discussions, and they also thank V. N. Novogrudskiy

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The Magnetization and the Magnetocaloric Effect of Manganese Phosphide

for assisting in measurements. There are 4 figures and 11 references, 5 of which are Soviet.

ASSOCIATION: Institut fiziki metallov Akademii nauk SSSR (Institute for Metal Physics of the Academy of Sciences, USSR)

SUBMITTED: October 23, 1958

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FAKIDOV, I. G.

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PHASE I BOOK EXPLOITATION SOV/5526

Vsesoyuznoye soveshchaniye po magnitnoy strukture ferromagnetikov, Krasnoyarsk, 1958.

Magnitnaya struktura ferromagnetikov; materialy Vsesoyuznogo soveshchaniya, 10 - 16 iyunya 1958 g., Krasnoyarsk (Magnetic Structure of Ferromagnetic Substances; Materials of the All-Union Conference on the Magnetic Structure of Ferromagnetic Substances, Held in Krasnoyarsk 10 - 16 June, 1958) Novosibirsk, Izd-vo Sibirskogo otd. AN SSSR, 1960. 249 p. Errata slip inserted. 1,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut fiziki Sibirskogo otdeleniya. Komissiya po magnetizmu pri Institute fiziki metallov OFMN.

Resp. Ed.: L. V. Kironskiy, Doctor of Physical and Mathematical Sciences; Ed.: R. L. Dudnik; Tech. Ed.: A. F. Mazurova.

PURPOSE: This collection of articles is intended for researchers in ferromagnetism and for metal scientists.

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Magnetic Structure (Cont.) SOV/5526

COVERAGE: The collection contains 38 scientific articles presented at the All-Union Conference on the Magnetic Structure of Ferromagnetic Substances, held in Krasnoyarsk in June 1958. The material contains data on the magnetic structure of ferromagnetic materials and on the dynamics of the structure in relation to magnetic field changes, elastic stresses, and temperature. According to the Foreword the study of ferromagnetic materials had a successful beginning in the Soviet Union in the 1930's, was subsequently discontinued for many years, and was resumed in the 1950's. No personalities are mentioned. References accompany individual articles.

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Shur, Ya. S. [Institut fiziki metallov AN SSSR - Institute of Physics of Metals, AS USSR, Sverdlovsk]. On the Magnetic Structure of Ferromagnetic Substances 5

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Kirenskiy, L. V., A. I. Drokin, and D. A. Laptey [Institute of Physics, Siberian Branch AS USSR, Krasnoyarsk]. Effect of Elastic and Plastic Deformations on the Magnitude of Thermo-magnetic Hysteresis 201

Margolin, S. D., and I. G. Fakidov [Institute of Physics of Metals AS USSR, Sverdlovsk]. Magnetic Studies of Alloys of the Manganese - Germanium System 211

Kirenskiy, L. V., and B. P. Khromov [Institute of Physics, Siberian Branch AS USSR, Krasnoyarsk]. Study of the Approach-to-Saturation Law on Monocrystals of Iron Silicide 217

D'yakov, G. P. [Physics Department of the Moscow State University]. Current State of the Problem Concerning the Study of Parity Effects in the Approach-to-Saturation Region 227

FAKIDOV, I. G.

PHASE I BOOK EXPLOITATION SOV/4893

Vsesoyuznoye soveshchaniye po fizike, fiziko-khimicheskim svoystvam ferritov i fizicheskim osnovam ikh primeneniya. 3d, Minsk, 1959

Ferrity; fizicheskiye i fiziko-khimicheskiye svoystva. Doklady (Ferrites; Physical and Physicochemical Properties. Reports) Minsk, Izd-vo AN BSSR, 1960. 655 p. Errata slip inserted. 4,000 copies printed.

Sponsoring Agencies: Nauchnyy sovet po magnetizmu AN SSSR. Otdel fiziki tverdogo tela i poluprovodnikov AN BSSR.

Editorial Board: Resp. Ed.: N. N. Sirota, Academician of the Academy of Sciences BSSR; K. P. Belov, Professor; Ye. I. Kondorskiy, Professor; K. M. Polivanov, Professor; R. V. Telesnin, Professor; G. A. Smolenskiy, Professor; N. N. Shol'ts, Candidate of Physical and Mathematical Sciences; K. M. Smolyarenko; and L. A. Bashkirov; Ed. of Publishing House: S. Kholyavskiy; Tech. Ed.: I. Volokhanovich.

PURPOSE: This book is intended for physicists, physical chemists, radio electronics engineers, and technical personnel engaged in the production and use of ferromagnetic materials. It may also be used by students in advanced courses in radio electronics, physics, and physical chemistry.

COVERAGE: The book contains reports presented at the Third All-Union Conference on Ferrites held in Minsk, Belorussian SSR. The reports deal with magnetic transformations, electrical and galvanomagnetic properties of ferrites, studies of the growth of ferrite single crystals, problems in the chemical and physicochemical analysis of ferrites, studies of ferrites having rectangular hysteresis loops and multicomponent ferrite systems exhibiting spontaneous rectangularity, problems in magnetic attraction, highly coercive ferrites, magnetic spectroscopy, ferromagnetic resonance, magneto-optics, physical principles of using ferrite components in electrical circuits, anisotropy of electrical and magnetic properties, etc. The Committee on Magnetism, AS USSR (S. V. Vonsovskiy, Chairman) organized the conference. References accompany individual articles.

Ferrites (Cont.) SOV/4893

Samokhvalov, A. A., and ~~I. G. Fakidov~~. The Electrical Properties of Magnetite (Electrical Conductance, Galvanomagnetic, Thermoelectric, and Thermomagnetic Properties of Magnetite in the Temperature Range of 80 - 400°K) 272

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A060/A101

AUTHORS: Margolin, S.D., Fakidov, I.G.

TITLE: Magnetic investigation of alloys of the manganese-germanium system

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 11, 1961, 9, abstract 11Zh56. (V sb. "Magnitn. struktura ferromagnetikov". Novosibirsk, Sib. Otd. AN SSSR, 1960, 211 - 216)

TEXT: Alloys of Mn-Ge were prepared from electrolytic Mn (99.8%) purified of gases, oxides and impurities, and Ge (99.997%). A large number of alloys with >40% Ge content were prepared. On the basis of the data from microsections it was established that only in alloys with >50% Ge does one find exclusively a chemical combination of Mn_3Ge_2 and Ge. In the remaining alloys besides Mn_3Ge_2 one also finds Mn_5Ge_3. Magnetic measurements were carried out in fields up to 2700 oersteds at 77 - 350°K using the ballistic method. The measurements were carried out at a temperature variation at a rate of 0.2 -

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Magnetic investigation.......

0.5 deg/min. It was established that the investigated alloys have two points of ferromagnetic reversal. The true Curie point of these alloys is 283°K. The low temperature point of ferromagnetic reversal (130°K at a field of 2400 oersteds) is a phase transition of the first kind. The ferromagnetic state of the alloys is caused only by the Mn_3Ge_2 compound. The coercive force H_c of this alloy attains a maximum value of 520 oersteds at 231°K, and vanishes at 146 and 280°K. The anomalous course of the temperature dependence of the magnetization of the alloys under investigation is explained by the fact that they may be in one of two anti-ferromagnetic states depending on the temperature. At $T < 113°K$ the magnetic moments are oriented at an angle of 180° with respect to one another. At temperatures $> 113°K$ the magnetic moments turn by jump through a small angle, leading to the rise of an uncompensated magnetic moment. It is noted that H_c and the remanent magnetization, beginning at a field intensity of 1500 oersteds are independent of the field, whereas the magnetization of the same specimen continues to increase linearly.

A. Rusakov

[Abstracter's note: Complete translation]

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24.7600

AUTHORS: Samokhvalov, A. A., Fakidov, I. G.

TITLE: Galvanomagnetic Properties of a Magnetic Single Crystal in the Temperature Range 0 ÷ 100°C

PERIODICAL: Fizika tverdogo tela, 1960, Vol. 2, No. 3, pp. 414-419

TEXT: The aim of the authors was to investigate the galvanomagnetic effects of magnetite in a temperature range which was sufficiently distant from the Curie point and the low-temperature transition range in order to explain the characteristic features of the Hall effect and the changes of electrical resistance in the magnetic field of a semiconducting ferromagnetic material. The investigations were made on two samples of naturally-occurring magnetite which were split off from a large octahedral single crystal parallel to (111). Sample 1 on which the Hall effect was measured had a size of 4.72x6.80x2.26 mm^3, sample 2 on which the conductivity changes were measured in the longitudinal and the transverse fields had a size of 4.87x9.30x2.16 mm^3. The position of the samples in

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Galvanomagnetic Properties of a Magnetic Single Crystal in the Temperature Range $0 \div 100^{\circ}C$

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the magnetic field is schematically illustrated in Fig. 1. The Hall effect was measured at field strengths of up to 20,000 oe at 10.1, 17.9, 22.1, 38, 61.6, and 93.6°C. The primary current flowing through the samples was between 20 and 100 ma; most of the measurements were made at 40 ma. Fig. 2 shows the Hall curves for 22 and 61.6°C; they are similar for the other temperatures. The Hall effect is given by the formula $E_x = (R_o H - R_1 4\pi M) jb$, where H is the field strength, M the magnetization of the sample, R_o and R_1 the Hall constants of the "ordinary" and the ferromagnetic parts (both have opposite signs), j the primary current density, and b the width of the sample. Fig. 3 shows $R_1(T)$, Fig. 4 $R_o(T)$. The width of the forbidden zone was determined from several series ($\Delta E \simeq 0.03 - 0.05$ ev). The change of the resistivity of magnetite in the magnetic field was measured up to 13,000 oe at 21.6, 33.9, 47.2, 62.8, 72, 82, and 94.1°C. Fig. 5 shows the temperature dependence of resistivity, Fig. 6 $\frac{\Delta r}{r}$ (H), and Fig. 7 $\frac{\Delta r}{r}$ (T) for longitudinal and transverse fields. The magnetization curves were measured on two samples perpendicular to one another (Fig. 8). In

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the longitudinal position, saturation occurs at H_e = 800 - 1,000 oe, in transverse position at 3,800 - 4,200 oe. The results of the investigations are compiled as follows: 1) in the temperature range investigated, R_0, R_1, the resistivity ϱ, and $\varrho(H)$ increase with reduced temperature; 2) $R_1 \sim \varrho^m$ (Fig. 9 shows that $\ln R_1 = f(\ln \varrho)$); 3) The temperature courses of R_0 and ϱ correspond to a reduction in electron conductivity ($n \simeq 10^{20}/cm^3$) and to an increase in their mobility ($u \simeq 6$ $cm^2/v.sec$) with reduced temperature, which is in agreement with the semiconductor character of the electrical conductivity of magnetite. N. S. Akulov is mentioned. There are 9 figures and 11 references: 5 Soviet, 3 US, 1 Dutch, 1 Japanese, and 1 German.

ASSOCIATION: Institut fiziki metallov Sverdlovsk (Institute of Metal Physics, Sverdlovsk)

SUBMITTED: May 25, 1959

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AUTHORS: Samokhvalov, A.A., and Fakidov, I.G.

TITLE: Nernst-Ettingshausen Thermomagnetic Effects in Magnetite

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 1, pp 31-35 (USSR)

ABSTRACT: Measurements were carried out on three specimens which were cut out from a natural monocrystal of magnetite in the (111) plane. The specimens were plates of the following dimensions: 17.70 x 7.44 x 2.36 mm (specimen 1) and 9.22 x 6.99 x 2.18 mm (specimen 2). In the measurements of the longitudinal N-E effect, the direction of the e.m.f. measured coincided with that of heat flow in the plane (111) in the direction [110]. The experimental set-up and the position of the electrodes were the same as those used in measuring the temperature dependence of the thermoelectric power by Samokhvalov et al (Ref 4). For measuring the transverse N-E effect, at low values of the latter, the set-up was altered somewhat in order to increase the temperature difference in the specimen (Fig 1). The temperature of the specimen was measured by a copper-constantan thermocouple which

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was soldered to the sides of the specimen. In all cases the magnetic field coincided with the crystallographic direction [111] of the magnetite. Measurements were carried out by the usual compensation method (see, e.g. Ref 5) by means of a KL-48 potentiometer and a GPZ-2 galvanometer. When the effects were small, measurements were carried out with an amplifier of the FEOU-18 type, with a sensitivity of 4×10^{-9} V/mm. In measurements of the transverse N-E effect, the temperature difference in the specimen was maintained at from 10 to 13 °C in the transformation range, and from 30 to 60 °C at room temperature. During the longitudinal effect measurements the temperature difference was 4-10 °C. The magnetisation curve of magnetite in the transformation range depends essentially on the mode in which the specimen had been cooled, i.e. whether the specimen had been cooled in a magnetic field or not. In order that the experimental conditions should be identical, the measurements of the effects in the transformation range were always carried out during heating of the specimen from liquid nitrogen temperature to which the specimen had been first cooled

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without application of magnetic field. In order to avoid spurious e.m.f.'s the effects were measured for various directions of the magnetic field; prior to measurement, the specimens were demagnetised. Fig 2 shows the temperature dependence of the dimensionless magnitude of the transverse N-E effect, measured at a magnetic field intensity H, of 20,400 oersted (specimen 1). The dependence of the N-E effect on the magnetic field intensity at a temperature of 228 °K and with a temperature difference of 60 °C across the specimen, is shown in Fig 3. Fig 4 shows the temperature dependence of the longitudinal N-E effect in magnetite at H = 20,400 oe. Fig 5 shows the dependence of the longitudinal N-E effect in magnetite on the magnetic field intensity at various temperatures. From the experimental values of the effective magnetic field the mobility of current carriers in magnetite can be estimated according to formulae of the kinetic theory of transport processes in semi-conductors. The magnitude and temperature dependence of the mobility thus obtained (in the ferromagnetic state)

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coincide in their order of magnitude with the Hall mobility (Refs 1, 2). The negative sign of the transverse N-E effect (in the region of the usual ferromagnetic state of magnetite) represents scattering of current carriers by the optical oscillations of the lattice. This confirms the view held about the preferentially ionic nature of the interatomic bonding forces in magnetite. The sharp anomalies in thermomagnetic effects in the region of low temperature transformations show that there must be a radical change in the energy spectrum of the conduction electrons. The existence of the anomalous behaviour of $\Delta\alpha/\alpha$ (the transverse N-E effect) at a temperature of 93 °K confirms the hypothesis (Refs 3, 4) that some phenomena, associated with low temperature transformation, can occur in a wide temperature range (of the order of 14-18 °C).

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There are 5 figures and 6 Soviet references.

ASSOCIATION: Institut fiziki metallov AN SSSR
(Institute of Physics of Metals, Acad.Sci. USSR)

SUBMITTED: March 12, 1959

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E021/E191

AUTHORS: Gaydukov, L.G., Novogrudskiy, V.N. and Fakidov, I.G.

TITLE: The Problem of the Phase Composition of the Chromium-Tellurium System. Letter to the Editor.

PERIODICAL: Fizika metallov i metallovedeniye, 1960, Vol 9, Nr 1, pp 152-154 (USSR)

ABSTRACT: X-ray and magnetic measurements have been carried out by Haraldsen but still insufficient work has been done on the Cr-Te system. Therefore further electrical and magnetic measurements were made. Alloys containing 5 to 95 atomic % Te were prepared from Cr and Te powders. Alloys containing up to 50% atomic % Te were heat-treated at 700 °C and those with more than 50% at 500 °C for 50 hours. All the prepared alloys were ferromagnetic at the temperature of liquid nitrogen. The temperature dependence of the electrical resistance of the alloys was studied, from which the Curie temperature was found. This was checked by the effect of temperature on the magnetic properties. Metallographic examination showed that the region of solid solution, if it exists, is in the region

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The Problem of the Phase Composition of the Chromium-Tellurium System

50-65 atomic % Te (see Fig 1б). All other alloys had two phases (Fig 1a, 1в). With less than 56 atomic % Te, only one phase is ferromagnetic, with a Curie temperature of 57 °C. With more than 56 atomic % Te, there are two ferromagnetic phases with two Curie points (-70 and 25 °C).
There are 2 figures and 2 references, of which 1 is German and 1 is Soviet.

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ASSOCIATION: Institut fiziki metallov AN SSSR (Institute of Physics of Metals, Acad.Sci. USSR)
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SUBMITTED: July 20, 1959